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ALSTON & BIRD LLP
BANK OF AMERICA PLAZA
101 SOUTH TRYON STREET, SUITE 4000
CHARLOTTE, NC 28280-4000

EXAMINER	
MILLS, DONALD L	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/720,701	JWA, JEONG-WOO	
	Examiner	**Art Unit**	
	DONALD L. MILLS	2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _06 February 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-16_ is/are pending in the application.

4a) Of the above claim(s) _8-12_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-7 and 13-16_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _02/14/2007 and 08/29/2005_.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 2 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Ikeda (US 5,471,464), hereinafter Ikeda.

Regarding claim 1, Ikeda (US 5,471,464) discloses in the summary of the invention, an OFDM wireless communication system comprising:

a transmitter for performing IDFT (inverse discrete Fourier transform) on an information transmit vector at least twice to modulate them into an OFDM (orthogonal frequency division multiplexing) signal [a first IDFT means for performing IDFT on a first digital component signal to produce a first time signal and a second IDFT means for performing IDFT on a second digital component signal in an orthogonal relationship with the first digital signal to produce a second time signal, see col. 6, lines 47-65], transmitting the modulated OFDM signal through a multi-path fading channel, modulating a pilot symbol vector for predicting an amplitude and a phase of the multi-path fading channel into an OFDM signal [the IDFT circuit is performed so that the frequency region I and Q channel signals are converted to time region signals, thereby making the IDFT coefficient corresponding to a predetermined carrier wave signal in the IDFT

processing results a fixed value, see col. 17, lines 7-10], and transmitting the modulated OFDM signal through the multi- path fading channel [the RF converter 318 converts the signal restricted in the bandpass filter to the transmission frequency and sends it out over the air as signal for the transmission antenna 319, see co1.17, lines 5-54]; and

a receiver for demodulating the pilot symbol vector received through the multi-path fading channel to predict the amplitude and the phase of the multi-path fading channel [the tuner converts the received RF signal captured by the receiving antenna into a predetermined intermediate frequency signal, see col. 18, lines 8-12], using the predicted amplitude and phase to compensate the amplitude and the phase multiplied to the received information transmit vector [the low pass filters pass the predetermined frequency component signals in the base band converted in frequency by the multiplies and frequency components with higher outliers are removed, see col. 18 lines 63-67], performing DFT (discrete Fourier transform) on the compensated information transmit vector to average a noise signal value increased by the channel compensation in a specific interval with an amplitude of the channel with less than a mean value into a mean value within an OFDM symbol interval, and outputting the mean value [the DFT circuit perform DFT processing on the digital signals output and converting the digital signals from the time region to the frequency region, see col. 19, lines 8-12].

wherein the transmitter comprises a first IDFT unit for performing IDFT on the information transmit vectors and outputting IDFT-performed signals; and a second IDFT unit for performing IDFT on the IDFT-performed signals output from the first IDFT unit to modulate them into OFDM signals [a first IDFT means for performing IDFT on a first digital component signal to produce a first time signal and a second IDFT means for performing IDFT on a second

digital component signal in an orthogonal relationship with the first digital signal to produce a second time signal, see col. 6, lines 47-49], and

wherein the receiver comprises a first DFT unit for demodulating the received information transmit vectors into OFDM signals; and a second DFT unit for performing DFT on the compensated information transmit vectors and averaging a noise signal value which becomes enhanced in a specific interval with an amplitude of the channel with less than a mean value, to a mean value within a symbol interval [using one or more phase differences to generate an average phase difference, wherein determining the residual phases error is based on average phase differences and correcting phases of channel compensated data symbols is based on the determined residual phase error, see ppl, para 11].

Regarding claim 2, Ikeda (US 5,471,464) discloses of an OFDM wireless communication system of claim 1, wherein the transmitter comprises:

a mapper for mapping an externally received binary information sequence to symbols according to the MQAM (M-ary quadrature amplitude modulation) method [the modulation method of changing both the phase and amplitude of a plurality of carrier waves signal known as QAM, see co1.1, para l0 and Fig 3 -synchronization symbol signal];

a serial to parallel converter for converting the mapped symbols into vector data that are information transmit vectors and outputting the information transmit vectors to the first IDFT [see Fig 1 - SIP converter 861];

a third IDFT unit for modulating a pilot symbol vector for. predicting the amplitude and phase of the multi-path fading channel into an OFDM signal [the IDFT circuit is performed so that the frequency region I and Q channel signals are converted to time region signals, thereby

making the IDFT coefficient corresponding to a predetermined carrier wave signal in the IDFT processing results a fixed value, see col. 17, lines 3-10]; and

a parallel to serial converter and guard interval inserter for inserting a guard interval into the signal received from the second IDFT unit, converting the guard interval inserted information transmit vector into a serial signal and transmitting it, and converting the guard interval inserted pilot symbol vector into a serial signal and transmitting it [a first guard interval adding means provided after first IDFT means and the second guard interval adds second time region signal after IDFT means, see col. 7, lines 18-24 and Fig 5 - PIS converters 304 and 305].

Regarding claim 7, Ikeda (US 5,471,464) discloses a wireless communication system including a transmitter for transmitting data using a multi-path fading channel and a receiver for receiving them from the transmitter, comprising:

a mapper for mapping an externally received binary information sequence to at least one symbol according to the MQAM (M-ary quadrature amplitude modulation) method [a plurality of carrier wave signals N of the modulated signals and QAM modulation is performed on a plurality of symbols, see col. 10, lines 63-65];

a serial to parallel converter for converting the mapped symbols into vector data which are information transmit vectors [see Fig 1 - SIP converter 861];

a first IDFT (inverse discrete Fourier transform) unit including m IDFT units for performing IDFT on the converted information transmit vectors [a first IDFT means for performing IDFT on a first digital component signal to produce a first time signal and a second IDFT means for performing IDFT on a second digital component signal in an orthogonal relationship with the first digital signal to produce a second time signal, see col. 6, col. 47-59];

an interleaver for writing sub-channel values of the respective transmit vectors received from the IDFT unit in an mxn memory buffer in the first direction [the converters converts the IDFT circuit to P/S to the buffer memories. The buffer memories 306 and 307 perform processing such as adding guard intervals to the signals input from the P/S converters and outputs the same to the D/A converters, see co1.17, lines 18-22];

a second IDFT unit including n IDFT units for reading the sub-channel values written in the first direction in the second direction when the writing in the first direction is finished, performing IDFT on the read sub-channel values, and modulating them to OFDM (orthogonal frequency division multiplexing) signals [a first IDFT means for performing IDFT on a first digital component signal to produce a first time signal and a second IDFT means for performing IDFT on a second digital component signal in an orthogonal relationship with the first digital signal to produce a second time signal, see col. 6, col. 50-64];

a third IDFT unit for modulating a pilot symbol vector for predicting an amplitude and a phase of the multi-path fading channel to an OFDM signal [the IDFT circuit is performed so that the frequency region I and Q channel signals are converted to time region signals, thereby making the IDFT coefficient corresponding to a predetermined carrier wave signal in the IDFT processing results a fixed value, see col. 17, lines 3-10]; and

a parallel to serial converter and guard interval inserter for inserting a guard interval into the signal received from the second IDFT unit, converting the guard interval inserted information transmit vector into a serial signal, transmitting the serial signal, converting the guard interval inserted pilot symbol vector into a serial signal, and transmitting it to the transmitter [a first guard interval adding means provided after first IDFT means and the second guard interval adds

second time region signal after IDFT means, col. 7, lines 18-24 and Fig 5 - PIS converters 304 and 305].

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 3-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ikeda (US 5,471,464) in view Zhang (2005/0276254 A1).

Regarding claim 3, Ikeda (US 5,471,464) discloses of the OFDM wireless communication system of claim 2, wherein the receiver comprises:

a guard interval eliminator and serial to parallel converter for eliminating the guard interval from the converted and received serial signal, and converting the guard interval eliminated serial signal into an information transmit vector and a pilot symbol vector respectively [both orthogonal signals converted to serial signals in the P/S converters are processed to remove the guard intervals added at the time of modulation and are outputted orthogonally as digital format I and Q channel signals, see para40];

a third DFT unit for demodulating the converted pilot symbol vector into an OFDM signal [the DFT time window is synchronized, output is based on outputs of the converters for accurate phase, see col. 19, lines 60-65];

a channel predictor and interpolator for predicting the amplitude and phase of the multi-path fading channel using the demodulated pilot symbol vector [the amplitude comparison circuits compares squared values with the reference value REF output from the reference value; when the square value is lower than the reference, the symbol is detected as 1, see col. 5, lines 5-9];

a parallel to serial converter for converting the signal received from the second DFT unit into a serial signal [Fig.7 - P/S converter 122]; and

a decoder for restoring the converted serial signal into a binary information sequence, and outputting the binary information sequence [the multiplexer selects and outputs decode value from the decoder 1285 for adjusting the phase of the DFT time window based on the level of the output signal, see col. 22, lines 48-52].

However, Ikeda (US 5,471,464) fails to explicitly disclose a channel compensator for compensating the amplitude and phase of the channel multiplied to the demodulated information transmit vector according to the predicted amplitude and phase of the channel.

Zhang (200510276254 A1) nevertheless, teaches of [the signal vector is corrected by removing the residual phase error in each element of the signal vector by multiplying the received signal with the estimated residual phase error, see para86, and steps 706 and 722 of the channel compensator in Fig 7].

At the time the invention was made, it would have been obvious to a person skilled in the art to modify the teachings of Ikeda (US 5,471,464) wherein, the phase error output being filtered by the low pass filter incorporates Zhang's receiver processing unit 500 to remove the largest maximum magnitude phase error as described in the removal process. The motivation

being to demodulate the OFDM signals by correctly reproducing the carrier wave signals to generate the DFT phase used in the DFT processing.

Additionally, Ikeda (US 5,471,464) fails to explicitly disclose a second DFT unit for performing DFT on the compensated channel signal, and averaging a noise signal value which becomes enhanced in a specific interval with an amplitude of the channel with less than a mean value, to a mean value within a symbol interval [the channel estimate is first compensated with the estimated residual phase error and then corrected channel estimate is used to correct the received signal vector. Next the phase differences are averaged, see para86-87, and step 718 of the channel compensator in Fig 7]. At the time of invention, it would have be obvious to a person skilled in the art to modify the teachings of Ikeda to incorporate the averaging process 518 as taught by Zhang in the synchronization unit to achieve a synchronized phase signal for the DFT time window. One of skilled in the art would have been motivated to remove the guard interval from received signals by correcting the output of the DFT time window for phase errors to span a predetermined frequency.

Regarding claim 4, Ikeda (US 5,471,464) discloses a system meeting all preceding limitations of the parent claim, however fails to disclose the OFDM wireless communication system of claim 2, wherein the channel compensator compensates the amplitude and phase of the channel through the MMSE (minimum mean square error) equalization method using the predicted amplitude and phase of the channel. Conversely, Zhang (200510276254 A1) teaches of channel estimation for compensation purposes. The method of estimation as computed in equations 9-17 is based on a previously known pilot symbol and a received pilot symbol. The channel gain error is based on the AWGN and ICI interferences and the phase error is based on

the gain. Thus, for one of ordinary skill in the art, it would have been obvious to derive from Zhang's linear equalization solution obtained using the MMSE optimization to perform variant calculations on concepts (phase, amplitude) to yield essentially similar and predictable results.

Regarding claim 5, Ikeda (US 5,471,464) discloses a system meeting all preceding limitations of the parent claim, however fails to disclose the OFDM wireless communication system of claim 4, wherein the channel compensator compensates the amplitude and phase of the channel through the ZF (zero forcing) equalization method using the predicted amplitude and phase of the channel. However Zhang (2005/0276254 A1) teaches of channel estimation for in Equations 20 and 21 where by the estimated error (channel gain) for an individual symbol is reduced to equation 21 if error is very small or zero. Therefore, for one of ordinary skill in the art; it would have been obvious to remove substantially minute error gain factors such as the channel estimator and angle residuals estimation in order to prevent degradation in the MMSE optimization.

Regarding claim 6, Ikeda (US 5,471,464) discloses a system meeting all preceding limitations of the parent claim, however fails to disclose the OFDM wireless communication system of claim 4, wherein the channel compensator compensates the amplitude and phase of the channel through a gain limit equalization method using the predicted amplitude and phase of the channel. However Zhang (200510276254 A1) teaches in Equations 22 and 23 of residual phase error estimation used for correcting received signals based on pilot based estimations. For one of ordinary skill in the art, it would have been obvious to first calculate the channel phase estimation error (gain), and then remove the calculated gain estimation factor from the overall estimation once it has been used to estimate the gain on the received signal. Therefore, the

motivation to derive from Zhang's linear equalization solution would be to reduce the effect of the error estimator on the received signal by preventing degradation in the MMSE optimization.

5. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ikeda (US 5,471,464) in view Zhang (2005/0276254 A1).

Regarding claim 13, Zhang (2005/0276254 A1) teaches of a method for compensating a channel in a wireless communication system for transmitting and receiving data using a multi-path fading channel, comprising:

(a) performing IDFT (inverse discrete Fourier transform) on information transmission vectors at least twice to modulate the vectors into OFDM (orthogonal frequency division multiplexing) signal, and transmitting the modulated signal through the multi-path fading channel [a pilot symbol is inserted into the converter to produce a total of M symbols; these data sequences are fed into an inverse Fourier transform from a mapping process; the signals are up-converted to a carrier frequency and transmitted over air-link, see pp3, para27];

(b) modulating a pilot symbol vector for predicting an amplitude and a phase of the multi-path fading channel into an OFDM signal, and transmitting the modulated signal through the multi-path fading channel [sub-channels may be used to transmit pilot signals wherein the pilot symbol is used to estimate the fading channel properties which corrupt the transmitted signal, see pp1, para7];

(c) demodulating the pilot symbol vector received through the multi-path fading channel to predict the amplitude and the phase of the multi-path fading channel [for transmission

channels with significant noise, channel compensation must be performed in each data block with the pilot symbols inserted in the given data block, see ppl, para7];

(d) compensating the amplitude and the phase of the channel multiplied to the received information transmit vector by using the predicted amplitude and the phase of the channel [a pilot-based signal correction is performed using a channel estimation process and a signal correction process, see pp5, para28, lines 11-12]; and

(e) performing DFT on the compensated channel signal, averaging a noise signal value enhanced by the channel compensation in a specific interval with an amplitude of the channel with less than a mean value into a mean value within an OFDM symbol interval, and outputting the mean value [using one or more phase differences to generate an average phase difference, wherein determining the residual phases error is based on average phase differences and correcting phases of channel compensated data symbols is based on the determined residual phase error, see ppl, para 11].

Zhang does not disclose wherein (a) comprises a first IDFT unit for performing IDFT on the information transmit vectors and outputting IDFT-performed signals; and a second IDFT unit for performing IDFT on the IDFT-performed signals output from the first IDFT unit to modulate them into OFDM signals, and wherein (b) comprises a first DFT unit for demodulating the received information transmit vectors into OFDM signals; and a second DFT unit for performing DFT on the compensated information transmit vectors and averaging a noise signal value which becomes enhanced in a specific interval with an amplitude of the channel with less than a mean value, to a mean value within a symbol interval.

Ikeda teaches a first IDFT means for performing IDFT on a first digital component signal to produce a first time signal and a second IDFT means for performing IDFT on a second digital component signal in an orthogonal relationship with the first digital signal to produce a second time signal, see col. 6, lines 47-49. And using one or more phase differences to generate an average phase difference, wherein determining the residual phases error is based on average phase differences and correcting phases of channel compensated data symbols is based on the determined residual phase error, see ppl, para 11.

At the time the invention was made, it would have been obvious to a person skilled in the art to modify the teachings of Zhang with the incorporated teachings of Ikeda (US 5,471,464) wherein, the phase error output being filtered by the low pass filter incorporates Zhang's receiver processing unit 500 to remove the largest maximum magnitude phase error as described in the removal process. The motivation being to demodulate the OFDM signals by correctly reproducing the carrier wave signals to generate the DFT phase used in the DFT processing.

Regarding claim 14, Zhang (2005/0276254 A1) discloses a method of claim 13, wherein (e) comprises using the MMSE (minimum mean square error) equalization method to compensate the amplitude and the phase of the channel multiplied to the received transmit vector [the residual phase error in each element in of the signal vector is / removed (MSE) by multiplying the received signal with the estimated gain error, see pp7, para86].

Regarding claim 15, Zhang (2005/0276254 A1) discloses of the method of claim 13, wherein (e) comprises using the ZF (zero forcing) equalization method to compensate the amplitude and the phase of the channel multiplied to the received transmit vector [if the channel estimation error is small that the OFDM block signal, is in deep fading, the channel gain is

almost zero, therefore the noise will be obtained only from the channel estimation and signal correction, see pp 5, paraS4].

Regarding claim 16, Zhang (200510276254 A1) discloses of the method of claim 13, wherein (e) comprises using the gain limit equalization method to compensate the amplitude and the phase of the channel multiplied to the received transmit vector [to reduce the residual phase error in the received constellation signals due to the pilot-based channel estimation, the estimation error is first calculated then removed from the received signals, see pp5, para56].

Response to Arguments

6. Applicant's arguments filed 06 February 2008 have been fully considered but they are not persuasive.

Rejection Under 35 USC 102

On page 12 of the remarks, regarding claims 1-4 and 13-16, the Applicant argues Ikeda does not disclose *performing transmit IDFT on information transmit vectors at least twice.* The Examiner respectfully disagrees. In an iterative operation, Ikeda discloses *performing transmit IDFT on information transmit vectors at least twice.*

On page 16 of the remarks, regarding claims 1-4 and 13-16, the Applicant argues Ikeda does not disclose Zhang does not disclose *wherein the transmitter comprises a first IDFT unit for performing IDFT on the information transmit vectors and outputting IDFT-performed signals; and a second IDFT unit for performing IDFT on the IDFT-performed signals output from the first IDFT unit to modulate them into OFDM signals and wherein the receiver comprises a first DFT unit for demodulating the received information transmit vectors into OFDM signals; and a*

second DFT unit for performing DFT on the compensated information transmit vectors and averaging a noise signal value which becomes enhanced in a specific interval with an amplitude of the channel with less than a mean value, to a mean value within a symbol interval. The Examiner respectfully disagrees. Ikeda discloses a first IDFT means for performing IDFT on a first digital component signal to produce a first time signal and a second IDFT means for performing IDFT on a second digital component signal in an orthogonal relationship with the first digital signal to produce a second time signal, see col. 6, lines 47-49. And using one or more phase differences to generate an average phase difference, wherein determining the residual phases error is based on average phase differences and correcting phases of channel compensated data symbols is based on the determined residual phase error, see ppl, para 11.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DONALD L. MILLS whose telephone number is (571)272-3094. The examiner can normally be reached on 9:00 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chi Pham can be reached on 571-272-3179. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Chi H Pham/
Supervisory Patent Examiner, Art Unit 2616

/Donald L Mills/
Examiner, Art Unit 2616
May 22, 2008